HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Hamma Hamma River Summer Chum Salmon Supplementation
Species or Hatchery Stock:	Summer chum salmon, *Oncorhynchus keta,* Hamma Hamma stock
Agency/Operator:	Washington Department of Fish and Wildlife / Long Live the Kings (USFWS funding)
Watershed and Region:	Hamma Hamma River, Hood Canal, Puget Sound, Washington State
Date Submitted:	October, 1999
Date Last Updated:	

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

The purpose of this hatchery and genetic management plan (HGMP) template is to provide a single source of hatchery information for comprehensive planning by the state and the tribes, and for permitting needs under the Endangered Species Act (ESA). The information should be the best scientific and commercial information available, as it will help determine if hatchery programs are likely to meet their goals and ESA obligations.

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of Program

Hamma Hamma summer chum Supplementation Project

1.2) Population (or stock) and species

summer chum salmon, *Oncorhynchus keta*, Hamma Hamma Stock
and impacts to
chinook salmon, *Oncorhynchus tshawytscha*, Hood Canal Stock

1.3) Responsible organization and individual:

Name(and title): Dr. Al Adams, Executive Director
Organization Hood Canal Salmon Enhancement Group
Address: PO Box 2169 Belfair, WA 98528
Telephone: (360) 275-3575
Fax: (360) 275-3575
Email: hcseg@hctc.com

Other organizations involved in the program:

Washington Department of Fish and Wildlife, Long Live the Kings

1.4) Location(s) of hatchery and associated facilities:

Washington State, Hood Canal
T24N, R03W, Sec 28 RSIs and rearing ponds located on Johns Creek
Lilliwaup hatchery located on Lilliwaup Creek.

1.5) Type of program:

Integrated Recovery

1.6) Purpose (Goal) of program:

The goal of the Hamma Hamma summer chum Supplementation Project is to contribute to the restoration of a healthy, naturally self –sustaining population of Hamma Hamma summer chum which maintains the genetic characteristic of the native stock.

1.7) Specific objective(s) of program

Supplement the indigenous summer chum population through artificial propagation and release of progeny secured from native broodstock for up to twelve years, speeding recovery of the population to abundances reflective of historic escapement levels.

1.8) List of Performance Indicators designated by "benefits" and "risks"

Reference Attachment 12D, Table 6, page 46

1.9) Approximate expected size of program

For the next three years, the expected releases will be between 62,500 and 125,000 fry. The 1997 release was approximately 12,000 fry. The 1998 release was approximately 2,000 fry. Returning adults in U.S. waters will be protected through implementation of harvest management measures specified in the Hood Canal Summer Chum Conservation Plan, with overall exploitation rates expected to be under 10 %. An official escapement goal for the Hamma Hamma summer chum population has yet to be established. The 1974-78 average run size for the population was 6,497.

1.10) Date program started or is expected to start:

The program began in 1997.

1.11) Expected duration of program:

Three generations, 12 years

1.12) Watersheds targeted by program:

Hamma Hamma River (WRIA 0251) and John Creek (WRIA 0253), a tributary to the Hamma Hamma River.

SECTION 2. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

2.1) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates. Indicate whether this HGMP is consistent with these plans and commitments, and explain any inconsistencies.

This program operates within the structure and protocols established in the "Artificial Production and Evaluation Plan for Summer Chum Salmon Populations in the Hood Canal and Strait of Juan de Fuca Regions", Attachment 12D, with additional oversight and technical support provided by PNPTC and WDFW.

2.2) Status of natural populations in target area.

The natural population targeted for the integrated recovery program is the Hamma Hamma River summer chum stock. The Co-managers have assigned a "moderate" extinction risk rating for this population through the Hood Canal Summer Chum Conservation Initiative.

2.2.1) Geographic and temporal spawning distribution.

Geographic distribution for summer chum and fall chinook:
Hamma Hamma River from mouth to falls (RM 0 to 4), and Johns Creek if sufficient water is available in the tributary during the summer chum return period to allow access to Johns Creek spawning reaches.

Summer chum run timing is approximately Aug 15- Oct. 15.
Chinook run timing is approximately Aug 15 – Nov 1.

2.1.2) Annual spawning abundance for as many years as available.

Summer chum spawning abundance
Reference Attachment 12B.
The average escapement from 1974-78 was 6,497 summer chum.
The average escapement from 1990-94 was 156 summer chum.
The average escapement from 1995-96 was 690 summer chum.
(unpublished WDFW data, and page 33 of the "Artificial Production and Evaluation Plan for Summer Chum Salmon Populations…)

Chinook spawning abundance
Hamma Hamma escapement estimates (WDFW data)

Yr		Yr		Yr		Yr	
97	0	89	26	81	26	74	108
96	11	88	66	80	106	73	252
95	25	87	21	79	278	72	171
94	78	86	0	78	36	71	425
93	28	85	660	77	317	70	300
92	52	84	309	76	252	69	300
91	30	83	224	75	268	68	400
90	35	82	55				

1998 escapement was greater than 91 chinook – more accurate data presently unavailable.

2.2.3) Progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for as many brood years as available.

Data are not available to identify these parameters for the supplemented summer chum population.

2.2.4) Annual proportions of hatchery and natural fish on natural spawning grounds for as many years as possible.

Summer chum

The program commenced in 1997, and hatchery-origin returns have not yet returned to natural spawning areas. The first returns of summer chum from the supplementation program are expected in 2000. At the present time, natural-origin fish comprise 100 % of the returns to the Hamma Hamma watershed. There are no records or anecdotal evidence of any summer chum artificial production in the Hamma Hamma River prior to the onset of the existing program.

Chinook

WDFW data (chinook Catch-Escapement Run Size Calculations Summary) do not indicate any hatchery returns to the Hamma Hamma River from 1968 through 1997. However, hatchery fry plants and RSI production are know to have occurred on a sporadic basis for several decades.

Data from recovered otoliths indicate that 46.3% of the 1998 chinook return to the Hamma Hamma River was the result of off-station plants (the Hamma Hamma chinook conservancy project.)

2.2.5) Status of natural population relative to critical and viable population thresholds.

The Hamma Hamma summer chum population is at "moderate" risk of extinction. Reference Attachment 12D, pages 50 and 183 (page 5 of the "Extinction Risk" addendum.)

The status and viability of natural Hood Canal chinook populations have not yet been determined.

2.3) Relationship to harvest objectives

Past harvest rates and expected future harvest rates on fish produced through the proposed program are detailed in the Harvest Management Plan section of the Hood Canal Summer Chum Salmon Conservation Initiative (see Attachment 12C, Table 3.7). Artificial production and harvest management plans have been integrated through the Hood Canal Summer Chum Salmon Conservation Initiative to recover regional stocks to healthy, sustainable levels.

2.4) Relationship to habitat protection and recovery strategies.

Reference attachment 12E, Hood Canal Summer Chum Salmon Conservation Initiative - Habitat Recovery Draft Plan, pages B38 – B41.

2.5) Ecological interactions

Describe salmonid and non-salmonid fishes or other species that could (1) negatively impact program; (2) be negatively impacted by program; (3) positively impact program; and (4) be positively impacted by program. Give careful considerations to the unlisted but listable indigenous species.

Hamma Hamma summer chum serve as prey for resident fishes in the local freshwater and estuarine systems. Predators likely include juvenile steelhead, cutthroat, juvenile coho and sculpin. Chinook salmon that interact with released summer chum fry may benefit from the program, if the chinook are a large enough size to allow for predation.

Summer chum are unlikely to prey on other fishes, and no species are expected to be negatively impacted through elevated predation risks by the program..

Competition for food resources may occur between hatchery-origin summer chum fry and pink salmon fry, and program summer chum fry and natural-origin fall chum fry in Hood Canal marine waters. The summer chum program intends to produce fry sufficiently large to feed in deeper water, offshore habitats, where competitive impacts with smaller, shoreline oriented, natural fry are reduced. Pink salmon are present in odd-numbered brood years, but have co-evolved with the summer chum populations. Summer chum will be released and emigrate from the estuary before chinook salmon juveniles enter the estuary. Fall chum released from Hood Canal hatcheries during the summer chum emigration period may compete with Hamma Hamma summer chum fry for potentially limiting food resources in marine waters.

Spawning interactions are possible between hatchery-produced Hamma Hamma summer chum and several other stocks, including pink salmon, naturally-spawned summer chum, and chinook salmon. However, given the historic numbers of summer chum in the Hamma Hamma relative to present abundances, these interactions are expected to be within the boundaries of natural behaviors. In addition, the large amount of spawning area available to returning salmon likely mitigates the potential for adverse interactions, including competition for spawning sites and redd superimposition. It is not anticipated that the program will create a negative impact on the spawning behavior of any of the other salmon species or on naturally-produced summer chum.

During outdoor rearing, bird predation will be prevented with bird netting covers on all summer chum rearing tanks and ponds.

Harbor seals may prey on returning summer chum adults. The magnitude of this predation relative to the total Hamma Hamma summer chum return is currently being evaluated by marine mammal researchers from WDFW.

During summer chum broodstocking activities there may be a disturbance and handling take of returning chinook salmon. The estimated 1999 escapement will be 31 chinook (the average

escapement over the previous 12 years – 3 generations). The estimated, incidental handling impact may be up to 75% of the returning fish or 23 chinook assuming recent year average return levels. In addition, up to 10 chinook may be handled if they are intercepted in the block seine to be used for the summer chum broodstock collection.

SECTION 3. WATER SOURCE

(See Attachment 12G).
The Hamma Hamma summer chum will be incubated in Remote Site Incubators (RSIs), supplied with water by several groundwater springs. This water source has a very stable temperature, which will generally be warmer than Hamma Hamma River water during the incubation period. Detailed thermograph data will be collected during the upcoming incubation period to provide a more precise overview of the thermal differentiation.

SECTION 4. FACILITIES

There are no physical structures associated with the Hamma Hamma summer chum recovery effort that are expected to impact naturally spawning Hamma Hamma chinook.

Attachment 12G presents a detailed description of incubation, rearing, and release protocols complete with physical plant descriptions.

One, for programs that directly take listed fish for use as brood stock, provide detailed information on catastrophe management, including safeguards against equipment failure, water loss, flooding, or other events that could lead to a high mortality of listed fish.
(See Attachment 12G).
In order to protect against catastrophic incubator failure, the compliment of Hamma Hamma summer chum eggs will be divided into at least three different RSIs during the green egg to eyed-egg incubation period. This strategy is designed to minimize the risk of loss due to failure of water supply systems by maintaining the eggs on at least three separate and independent sources. In addition, loading densities in the RSIs will be kept extremely low to maximize the available response time, allowing incubating eggs to survive in the incubators, in the event of water source failure. To accomplish this latter risk minimization measure, two 350 gallon RSIs will be used to incubate up to 20,000 eggs each, diminishing the likelihood for oxygen depletion, and suffocation of the eggs, in the vent of a water source failure.

As an additional safeguard, upon reaching the eyed-egg stage, each family will be split into two sections, with half of each family to be transferred to the Lilliwaup facility (reference Lilliwaup

HGMP) to further reduce the risk of catastrophic loss. The eggs at Lilliwaup will be returned to the Hamma Hamma ponds as fry for additional rearing, acclimation, and release.

The RSIs at Johns Creek will be monitored at least once daily under ideal conditions and at least twice daily in adverse conditions in order to ensure proper function. The water sources supplying the RSIs have in the past been very stable and reliable, with no catastrophic losses experienced in seven years of operation prior to 1998 for (mainly) fall chum production. A mass failure of a portion of the hillside above one RSI location in 1998 led to the loss of the majority of summer chum eggs incubated through the project last year. Record rain-falls last year contributed to the mass failure. The risk of a re-occurrence of this event is low. Incubation of summer chum eggs in three separate sites rather than one, and transfer of one-half of the 1999 brood eyed eggs to Lilliwaup Hatchery for continued incubation and rearing to the fry stage will minimize the risk of loss of propagated fish this season.

Two, describe any instance where construction or operation of the physical plant results in destruction or adverse modification of critical habitat designated for the listed species.
None

Three, describe any inconsistencies with standards and guidelines provided in any ESU-wide hatchery plan approved by the co-managers and NMFS.
The proposed supplementation program is consistent with standards and guidelines detailed in the artificial propagation plan portion of the Hood Canal Summer Chum Salmon Conservation Initiative, with one exception. The ESU-wide supplementation plan does not recommend the use of RSIs for the incubation of green eggs. (Reference attachment 12D, page 12). However this question has been resolved in subsequent discussions with the Co-managers in which risk minimization measures to reduce the likelihood for loss of fish (described above) were detailed, and the program is approved as described here.

In addition, agreement has been reached with the Co-managers on an appropriate broodstock collection methodology (Attachment 12F), which is not specifically described in the ESU-wide plan under the Hamma Hamma project description (Attachment 12D, page 50)

4.1) Brood stock collection

There are no physical structures associated with broodstocking.

4.2) Spawning

Spawning will be conducted under a temporary tent structure.

4.3) Incubation

Reference Attachment 12G.

4.4) Rearing

Reference Attachment 12G.

4.5) Acclimation/release

Reference Attachment 12G.

4.6) Other

None.

SECTION 5. ORIGIN AND IDENTITY OF BROOD STOCK

5.1) Source

Native summer chum adults returning to the Hamma Hamma River and Johns Creek.

5.2) Supporting information

5.2.1) History

Provide a brief narrative history of the brood stock sources. For natural populations, specify its status relative to critical and viable population thresholds (use section 2.2.5 if appropriate). For existing hatchery stocks, include information on how and when they were founded, and sources of brood stock since founding. If stock crosses, list stock of each sex.

Summer chum broodstock were first secured from the native run in the Hamma Hamma River (and John Creek) in 1997. No other summer chum stocks have been transferred into the drainage, or are planned for use in future years, through the supplementation program. The natural population has been assigned a "moderate: extinction risk status by the Co-managers.

5.2.2) Annual size

Include past brood stock sizes as well as proposed future sizes. Specify number of each sex, or total number and sex ratio, if known. For natural population brood stocks, explain how their use will affect their population status relative to critical and viable thresholds.

Fourteen summer chum were collected as broodstock in 1997, including 5 females and 9 males. In 1998, 32 fish were collected for use as broodstock: 15 females and 17 males. Future brood stock sizes are expected to be a minimum of 25 pairs, and a maximum of 50 pairs, at current run sizes. Broodstock collection levels for the project are consistent with criteria set forth in the Co-manager's "Artificial Production and Evaluation Plan" for the recovery of stocks at risk of extinction, and the maintenance of viable naturally spawning populations. (See Attachment 12F).

5.2.3) Past and proposed level of natural fish in brood stock.

If using an existing hatchery stock, include specific information on how many natural fish were incorporated into the brood stock annually.

All broodstock used in the program since 1997, and to be collected in 1999, are naturally produced summer chum. There are no returning hatchery fish expected until 2000 (97 BY), at which time a proportion of the broodstock secured from the Hamma Hamma River may be of hatchery-origin.

5.2.4) Genetic or ecological differences

There are no known genetic differences between the naturally-spawning population, and fish used as broodstock for the supplementation program.

5.2.5) Reasons for choosing

The Co-manager's "Artificial Production and Evaluation Plan" within the Hood Canal Summer Chum Salmon Conservation Initiative specifies that only native Hamma Hamma broodstock may be used for supplementation in the watershed. The proposed program is consistent with that plan.

5.3) Unknowns

Identify areas where a lack of data leads to uncertainties about the choice of brood stock.

There are no known areas where a lack of data would contribute to any uncertainties at this time.

SECTION 6. BROOD STOCK COLLECTION

Describe any inconsistencies with standards and guidelines provided in any ESU-wide hatchery plan approved by the co-managers and NMFS.

The proposed program is consistent with broodstock collection criteria set forth in the Co-manager's "Artificial Production and Evaluation Plan" of the Hood Canal Summer Chum Salmon Conservation Initiative.

6.1) Prioritized goals

List in order of priority the general goals for brood stock collection. Refer to sections 1.5 and 1.6.

Reference Attachment 12D, pages 88-90, and Attachment 12F.

6.2) Supporting information

6.2.1) Proposed number of each sex.

At current run sizes, a minimum of 25 of each sex, and a maximum of 50 of each sex are proposed for collection. Reference Attachment 12F.

6.2.2) Life-history stage to be collected (e.g., eggs, adults, etc.)

Adult fish in the Hamma Hamma watershed.

6.2.3) Collection or sampling design

Include information on the location, time, and method of capture. Describe capture efficiency and measures to reduce sources of bias that could lead to a non-representative sample of the desired brood stock source. Also, describe the method of capture (e.g. weir trap, beach seine, etc.) and quantify as take handling, behavior modification, stress, or mortality of listed fish.

Broodstock collection objectives and methods are described in Attachment 12F.

6.2.4) Identity

Describe method for identifying (a) target population if more than one population may be present; and (b) hatchery origin fish from naturally spawned fish.

There are no external marks on hatchery produced Hamma Hamma summer chum, and therefore no means of visually identifying naturally-spawned versus hatchery spawned fish. There are no returning hatchery fish expected until 2000 (97 BY.). All hatchery-origin summer chum have been otolith marked, so proportions of hatchery and natural-origin fish can be ascertained post-spawning beginning in 2000 and subsequent years.

6.2.5) Holding

Describe procedures for holding fish, especially if captured unripe or as juveniles. Quantify as take trapping, holding, stress or mortality of listed fish.

Adults will be segregated by sex and held in PVC tubes. The tubes are approximately 4' long and 10" in diameter, and have large holes drilled in them throughout their length to allow for the free exchange of water. Tubes containing fish will be secured by rope in quiescent areas within the river for holding until spawning. This method worked well in 1998 with no resulting adult mortalities. Reference Attachment 12F.

6.2.6) Disposition of carcasses

Scales, otoliths, and GSI samples are removed from carcasses immediately after spawning, and all carcasses are returned to the Hamma Hamma River..

6.3) Unknowns

Identify any data gaps that lead to uncertainties about brood stock collection.

The number of fish identified as available for use in the program is based on criteria set forth in the Co-manager's artificial production plan, as applied to pre-season expectations of the run-size to the Hamma Hamma River. An escapement of 200 summer chum is forecast in 1999, and this forecast must be used in lieu of inseason estimates of the actual run size.

SECTION 7. MATING

Describe any inconsistencies with standards and guidelines provided in any ESU-wide hatchery plan approved by the co-managers and NMFS.

Mating protocol applied in the proposed program is fully consistent with criteria set forth in the Co-manager's "Artificial Production and Evaluation Plan" of the Hood Canal Summer Chum Salmon Conservation Initiative (see Attachment 12D, pages 73-74).

7.1) Selection method

Specify how spawners are chosen, e.g. randomly over whole run, randomly from ripe fish on a certain day, selectively chosen, prioritized based on hatchery or natural origin, etc.

Spawners are chosen randomly across the run at large. Female summer chum collected for the program will be held in PVC tubes until ripe. Females will be hand-checked for ripeness at least twice per week, and will be spawned as soon as possible after ripeness is established. See Attachment 12F for further details.

7.2) Males

Specify expected use of backup males and repeat spawners.

Males will be used in the order captured, and will be live spawned until each male spawns with at least two and preferably three females (following factorial mating procedures). Back-up males are used to ensure fertilization. See Attachment 12F for further details.

7.3) Fertilization

Describe fertilization scheme, such as equal sex ratios and 1:1 individual matings; equal sex ratios and pooled gametes; or some other. Explain any fish health procedures used for disease prevention.

Spawning will be conducted using the 3x3 factorial method whenever possible, with back-up males used to ensure fertilization. This fertilization method conforms with criteria set forth in the ESU-wide hatchery plan, which requires at least 1x1 spawning.

7.4) Cryopreserved gametes

Cryopreservation is not presently used or needed as a means to preserve semen.

7.5) Unknowns

Identify any data gaps that lead to uncertainty in mating protocols.

No data gaps are as yet known.

SECTION 8. REARING AND INCUBATION

Provide current and previous goals and data. Include historic data for three generations or for years dependable data are available. Also, describe any inconsistencies with standards and guidelines provided in any ESU-wide hatchery plan approved by the co-managers and NMFS.

INCUBATION:

Reference Attachment 12D, page 77, and attachment 12G.

8.1) Loading density

Include description of the incubator(refer to Section 4.4). Also, provide measurement of egg size.

Reference Attachment 12G.

8.2) Influent and effluent gas concentration

(Dissolved Oxygen, and any other parameters monitored)

Influent and effluent gas concentrations, including dissolved oxygen levels, are at levels optimal for salmonid propagation.

8.3) Ponding

Describe degree of button up, cumulative temperature units, and mean length and weight (and distribution around the mean) at ponding. State dates of ponding, and whether swim up and ponding are volitional or forced.

Fry are ponded volitionally, as they egress from the RSIs. See Attachment 12G for further details.

8.4) Fish Health monitoring

Describe any diseases, yolk-sac malformation, and mortality.

Summer chum incubated in 1998 had no diseases and no observed yolk-sac malformation. Due to a catastrophic failure affecting the water source for the single RSI used to incubate summer chum in 1998, egg mortality exceeded 90%. Suffocation was the cause of mortality. Fish health will be monitored through compliance with Co-manager Fish Health Policy procedures.

REARING:

Reference Attachment 12D, pages 77-80, and Attachment 12G.

8.5) Density and loading.

Include a description of the rearing containers, such as start tanks, circulation, circulating ponds, flow through, etc. Refer to section 4.4.

Reference Attachment 12G.

8.6) Influent and effluent gas concentrations

(oxygen, carbon dioxide, total gas pressure).

Influent and effluent gas concentrations, including dissolved oxygen levels, are at levels optimal for salmonid propagation.

8.7) Length, weight, and condition factor.

Summer chum fry egressing from the RSIs for rearing will average approximately 35-36 mm in length, with an average weight of 0.36 grams, or 1,200 fpp. Fish will average 56 mm at release. The target individual fish weight at release is 1 gram, or 450 fpp.

8.8) Growth rate, energy reserves

(hepatosomatic index - liver weight/body weight) and body moisture content as an estimate of body fat concentration.

Growth rate will be maximized during the 30 to 45 day rearing period to achieve a fish size that minimizes predation loss and maximizes survival to adult return.

8.9) Food type and amount fed, and estimates of feed conversion efficiency.

BioDiet Starter for 2 weeks, then BioDiet Grower. Fish will be fed at a rate of up to 3.0 % body weight of the population per day. The expected food conversion factor is 1.2.

8.10) Health and disease monitoring.

Health and disease monitoring will be in compliance with Co-manager Fish Health Policy criteria.

8.11) Smolt development indices, if applicable

(e.g. gill ATPase activity).

All chum salmon are fully smolted upon swim-up.

8.12) Use of "natural" rearing methods.

The level of intervention involved with chum salmon fry propagation is very low, with fish rearing confined to a 30 to 45 day period. Fish are allowed to emerge and emigrate volitionally whenever possible. Feed is introduced to fry via influent water to minimize any risk of domestication that might ostensibly occur over the minimal amount of time that the chum salmon are reared.

8.13) Unknowns

Describe data gaps that lead to uncertainty in the incubation and rearing protocols.

None known.

SECTION 9. RELEASE

Provide current and previous goals and data. Include historic data for three generations or for years dependable data are available. Also, describe any inconsistencies with standards and guidelines provided in any ESU-wide hatchery plan approved by the co-managers and NMFS.

Reference Attachment 12D, pages 80-83, and Attachment 12G.

9.1) Life history stage, size, and age at release.

Program goals are to release fed fry during the natural-origin summer chum emigration period at an average, individual fish size of 1.0-1.5 grams, approximately 1 month after swim-up.

9.2) Life history stage, size and age of natural fish of same species in release area at time of release.

Natural fish are expected to be emigrating seaward as fry during the time of release.

9.3) Dates of release and release protocols.

Future releases are planned on the first appropriate day, with regard to tides, after March 1. Releases are volitional and release opportunity is timed to coincide with a receding high tide. Reference Attachment 12G.

9.4) Location(s) of release.

Johns Creek

9.5) Acclimation procedures.

One half of the annual production will be incubated and reared in the home watershed. Hamma Hamma summer chum reared at Lilliwaup will be returned to the rearing pond adjacent to Johns Creek for approximately one month of rearing and acclimation. Reference Attachment 12G.

9.6) Number of fish released

BY 97 release was 12,000. BY 98 fry release was 2,000. Releases within the next few years are expected to range from 62,500 – 125,000. Consistent with the Co-manager's Artificial Production and Evaluation Plan, when sufficient escapement and broodstock are available, up to 802,000 fed fry may be produced to help recover the population to average run size levels observed in the 1974-78 period (see Table AI-1 of the Co-manager's plan).

9.7) Marks used to identify hatchery adults.

All Hamma Hamma summer chum have thermally marked otoliths. Those fry incubated at the Lilliwaup facility will have a different otolith mark to distinguish the two groups and to help assess the level of straying by the two populations.

9.8) Unknowns

Describe data gaps that lead to uncertainty in the release protocols.

None known.

SECTION 10. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

Reference Attachment 12D, pages 21-25.

SECTION 11. RESEARCH

Provide the following information for any research programs conducted in association with the HGMP. Correlate with research described in any ESU hatchery plan approved by the co-managers and NMFS.

11.1) Objective or purpose

Collection of baseline biological information on summer chum salmon native to Hood Canal. Information collected will include fecundity, egg size, reproductive effort, pathogen screening, DNA/GSI sampling, gamete viability, occurrence of monstrosities in off-spring, and otolith-marking of all off-spring to estimate fry-to-adult survival rates in the supplemented population.

11.2) Cooperating and funding agencies

Washington Department of Fish and Wildlife.

11.3) Principle investigator or project supervisor and staff

Dr. Steve Schroder, Fisheries Research Scientist

11.4) Status of stock, particularly the group affected by project.

The Co-mangers have assigned a "moderate" extinction rating for this population.

11.5) Techniques: include capture methods, drugs, samples collected, tags applied

See "Broodstock Collection Protocols" for capture methods. Any drugs used will be applied consistent with Fish Health Policy procedures. Samples collected will include tissues from hard parts, flesh and internal organs for viral, GSI, and DNA samples**.** Ten eggs will be collected from each female for egg size determination. Scales will be removed for age determination. Beginning in 2000, otoliths will be sampled to determine origin of returning fish. Mortality data for the propagated population will be collected during the incubation and rearing period. Length, weight, and condition factor data will be collected from fry produced at release**.**

11.6) Dates or time period in which research activity occurs

Research activities will occur from late August through the following March each year.

11.7) Care and maintenance of live fish or eggs, holding duration, transport methods

Methods employed will be the same as described in the attached "Incubation, Rearing, and Release Protocols".

11.8) Level of take: number or range of fish handled, injured, or killed by sex, age, or size

See "Broodstock Collection Protocols" and above text. Research activities described above will not lead to an increased take level.

11.9) Potential for / estimates of injury or mortality, and methods to reduce either.

Injury or mortality levels will not increase because these activities will be a part of, and directly linked to, the standard hatchery procedures proposed in this HGMP.

11.10) Alternative methods to achieve project objectives

None.

11.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project

None anticipated.

SECTION 12. ATTACHMENTS AND CITATIONS

Attach or cite (where commonly available) relevant reports that describe the hatchery operation and impacts on the listed species or its critical habitat. Include any EISs, EAs, Biological Assessments, or other analysis or plans that provide pertinent background information to facilitate evaluation of the HGMP.

A. does not exist, included for consistent numbering between templates.
B. Summer chum salmon spawning escapement estimates for Hood Canal/Strait of Juan de Fuca 1968-1998, from Part 1, Summer Chum Salmon Conservation Initiative, Table 1.1
C. Summer chum harvest rate summary, from Summer Chum Salmon Conservation Initiative, Harvest Management Plan draft, Table 3.7.
D. Summer Chum Salmon Conservation Initiative, Artificial Production and Evaluation Plan, draft dated June 11, 1999. *Previously provided to NMFS and not attached here.*
E. Summer Chum Salmon Conservation Initiative, Habitat Recovery Plan, draft dated March 23, 1999. *Previously provided to NMFS and not attached here.*
F. Broodstock Collection Protocols, Hamma Hamma Summer Chum Project. Brood Year 1999

G. Incubation, Rearing, and Release Protocols, Hamma Hamma Summer Chum Project, Brood Year 1999

Attachments -

F. Broodstock Collection Protocols, Hamma Hamma Summer Chum Project. Brood Year 1999

The following procedures to be applied for the collection of broodstock in the Hamma Hamma River have been developed by Hood Canal Salmon Enhancement Group and Long Live the Kings staff, with technical support from the Washington Department of Fish and Wildlife and Point No Point Treaty Council. All of these techniques were utilized last year without any resulting mortality, (other than the expected mortality associated with spawning and extended holding of males in a freshwater environment.)

Capture Techniques

Two capture techniques will be utilized: the hook-and-line capture method, and with a block seine. Two snorkelers will float down the river from the blue hole (river mile 2) to a block seine erected at river mile 1. The snorkelers will either capture fish using the hook-and-line method (the preferred and primary method for collecting broodstock) or they will drive fish downstream into the seine (the secondary, back-up collection method). Regardless of the method used, care will be taken to avoid capture and displacement of summer chum in the act of spawning to allow completion of redds.

The Hood-and Line Capture Method -

This method will be used primarily by the snorkelers. The capture apparatus is a large barbless fish hook, fitted to a metal cap and a heavy duty line. The cap is attached to the shank of the hook with the opening facing toward the eye. A thin wooden stick is fitted into the cap, creating a gaff hook with a disengaging staff. The diver holds the stick and the line, keeping pressure on the hook, until a fish is engaged. The diver uses the stick to hook the fish on the dorsal half of the caudal peduncal, anterior to or even with the adipose fin. The diver then releases the stick and retrieves the fish with the line.

The Block Seine Capture Method -

The block seine will be manned with at least three people. The seine operators will be trained by LLTK and WDFW staff in proper fish handling techniques. All non-targeted fish will be captured by hand from the seine and gently passed downstream Any summer chum encountered will be retained up to the weekly broodstock collection goal. Care will be taken to avoid walking on summer chum redds during operation of the seine. If large numbers of pink or fall chinook salmon are collecting in the seine, the operators will lift the lead line to allow the fish to escape downstream, rather than handling individual fish.

Number of Fish to be Collected

Based on preseason forecasts derived from recent year return levels, the expected 1999 escapement is 200 summer chum. According to the ESU-wide recovery plan, the appropriate number of fish to be

collected for broodstock from a return of 200 fish is 50 pairs (page 16, "Artificial Production and Evaluation Plan for Summer Chum Populations in the Hood Canal and Strait of Juan de Fuca Regions"). These numbers will be reviewed mid-way through the run to accommodate any in-season variations in return size.

A weekly target number of fish to be collected has been established based on the expected escapement and "early", average, and "late" run timing curves (see below). The attached table, based upon these curves, indicates the weekly proportions of the total return that should be collected. These numbers will be reviewed mid-way through the run to accommodate any inseason variations in run size or timing. The number of fish to be collected each week will be either the target number or half of the weekly escapement, whichever is lower. The minimum number of fish to be collected for the season is 25 pairs.

Timing and Duration

Broodstock will be collected between August 15 and October 15. Collection will occur on Monday, Wednesday and Friday of each week, or on Tuesday and Thursday on those weeks that the work week begins on Tuesday. Collection will last only until the weekly collection goal has been reached, and then discontinued until the following week.

Broodstock Holding

Adults will be segregated by sex and held in PVC tubes. The tubes are approximately 4' long and 10" in diameter, and have large holes drilled in them throughout their length to allow the free exchange of water. These tubes are large enough to accommodate up to three fish each for short periods. However, for this program, only one female will be held per tube, while males may be held up to three per tube. For holding periods greater than 12 hours, loading rates for both sexes will be one fish per tube. The tubes holding fish will be placed in the river in backwater areas and secured to a fixed object on the bank with rope.

Fish will be held in the tubes until spawned. Females will be checked for ripeness upon capture and twice per week thereafter, and will spawned as soon as possible. Males will be live-spawned and returned to the tubes until they either spawn with three or more females or until they expire.

G. Incubation, Rearing, and Release Protocols, Hamma Hamma Summer Chum Project, Brood Year 1999

The following procedures have been developed by Hood Canal Salmon Enhancement Group and Long Live the Kings staff with technical support from the Washington Department of Fish and Wildlife and Point No Point Treaty Council.

Physical Plant Description

There will be two different sizes of remote site incubator (RSI) barrels used. There are two 350 gallon RSIs, and the more standard 55 gallon RSIs. The 350 gallon barrels can accommodate up to one

million salmon eggs, but will only be used to incubate very low numbers of eggs (25,000 to 50,000 summer chum eggs each) as a risk aversion measure, depending on the final egg take. The 55 gallon barrels, which are each capable of safely incubating 125,000 eggs, will be used to incubate between 2,500 and 5,000 eggs each, again depending on the final egg take.

Water flow regulation into the RSIs is accomplished by locating an in-line valve between the spring-fed water sources and the barrel. Water flows into the barrel through a flow diffuser about one inch from the bottom, and flows out of the barrel a few inches from the top, creating an upwelling of water through artificial incubation substrate, and eggs suspended on screens above the substrate, in the barrel. An in-line stand pipe between the valve and the barrel allows the barrel to be rapidly drained without disturbing the eggs.

Approximately 16 to 20" of artificial substrate is placed in the barrel as incubation substrate for alevins. Green eggs are incubated on screened trays above the substrate, then shocked and picked as eyed eggs. The eyed eggs are then placed within the artificial substrate, which provides an appropriate environment for hatching sac fry. Upon yolk absorption, egressing fry can then move up through the substrate and exit through the outlet pipe volitionally.

Each RSI site will also have some form of head box or head trough, which functions as a silt trap. This head trough will also be used to thermally otolith mark the eyed eggs. Buckets of frozen water are placed in the head trough for the prescribed period of time to place a mark on the otoliths of the eyed eggs.

Incubation

Green eggs will be incubated in RSIs located on spring-fed tributaries to Johns Creek. The eggs will be split into three sites, each with its own spring water supply, in order to minimize the likelihood that the entire population would be lost due to water supply failure. All eggs will be incubated to the eyed egg stage at Johns Creek, then each family will be split in half, with one half of the eggs remaining in the Johns Creek incubators and the other half being transported to Lilliwaup Hatchery for incubation. This step is being initiated to further diminish the risk of catastrophic loss of summer chum due to RSI failure.

The three RSI sites are described as follows. The attached site map indicates the location of each RSI at the conservancy site.

Pond E

The source of water for the RSI proposed for this site is a spring-fed pond created in a small depression about five years ago. There is no outlet stream for the pond, as the water flows out the bottom of the pond through a pocket of gravel. The pond is crystal clear and has had very little silt input since its creation. To create a water supply for the RSI, a screened intake will be placed in the pond. Water will then be gravity-fed from the intake to a 350 gallon RSI located approximately 50 feet downhill. The RSI effluent pipe will lead to another nearby spring-fed stream, approximately 150 feet uphill from Johns Creek.

Susserous Spring
The spring that will be used to supply the RSI at this site flows out of the ground underneath a hollow stump. This site was used for incubation in the 1980's, but has been abandoned for eight years. Despite the lack of maintenance, the intake pipe has continued to provide a steady stream of water to the present. This site will also have a 350 gallon RSI. The RSI outlet pipe will lead approximately 50 feet directly into Johns Creek.

Pond A
This site is presently being used to rear steelhead from the 1998 brood and to incubate steelhead from the 1999 brood. The steelhead will have been removed from these incubators by the time that summer chum eggs are available. There are two 55 gallon barrels presently plumbed, and more can be added if necessary. This is a proven site, as the water source has been used for at least three years to incubate eggs and is considered very stable.

Eyed eggs transported to Lilliwaup Hatchery will be reared in RSIs installed in the hatchery building, and fry will volitionally release into 4' circular tanks before being transported to Johns Creek for rearing and acclimation. These fry will be placed in tanks at the Pond D site (see attached site map), which is currently being used to incubate steelhead from the 1999 brood.

Each RSI will be inspected daily under standard conditions (e.g. normal rain-fall conditions, no freezing), and twice daily during adverse conditions (e.g. during heavy rain-fall periods), in order to ensure proper function of the RSI and the security of the water source.

Rearing
The outlet pipes for all the RSIs will lead into 4'x4'x4' fiberglass tanks or larger raceways, into which the emerging fry will volitionally emigrate. Loading densities have not yet been determined, but will be kept well below levels set forth in the Co-manager's "Artificial Production and Evaluation Plan". Each of these tanks will be covered with bird netting to prevent predation. As per the ESU-wide plan, these fry will be fed for approximately one month and released in the first week of March during the natural summer chum emigration period. Feed will be introduced to the fry by placing it in the RSI and allowing it to flow into the rearing tank via the RSI outlet pipe. Although the level of intervention into the natural chum life cycle associated with the hatchery supplementation program is low, this technique is intended to minimize the risk of potential domestication effects.

Release
Fry will be released in the first week of March. They will be released en masse at dusk, during a period of receding high tides. Feed will be discontinued for one day prior to release, and the outlet screen will be removed from each tank to allow the fry to volitionally release. Fry remaining in the tank the following day will be force-released the following dusk.

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Summer chum salmon ESU/Population: Hood Canal Summer Chum ESU / Hamma Hamma Activity: Supplementation				
Location of hatchery Hamma Hamma (John Creek) remote site /LLTK Lilliwaup Hatchery **Dates of activity: August -May Hatchery program operator: Hood Canal Salmon Enhancement Group/Long Live the Kings**				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)			100	200
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)			100	
Intentional lethal take f)				
Unintentional lethal take g)			2	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.